PATENT ABSTRACTS OF JAPAN

(11)Publication number : 2004-087238
(43)Date of publication of application : 18.03.2004

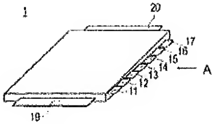
(51)Int.Cl. H01M 2/20
H01M 4/02
H01M 4/48
H01M 4/58
H01M 4/62
H01M 10/40
H01M 10/44
H01M 10/48

(21)Application number : 2002-245144
(22)Date of filing : 26.08.2002

(71)Applicant : NISSAN MOTOR CO LTD
(72)Inventor : HISAMITSU YASUNARI
FUKUZAWA TATSUHIRO
NEMOTO KOICHI
OSAWA YASUHIKO

(54) LAYER BUILT CELL

(57)Abstract:
PROBLEM TO BE SOLVED: To provide a layer built cell for measuring a voltage for each cell.
SOLUTION: In a layer built cell 1, tab electrodes 11-17 for measuring shared voltages for measuring voltages for each cell are provided at each cell, and the tap electrodes 11-17 for measuring shared voltages are arranged so that those that are at least adjacent are not at the same potential.



CLAIMS

[Claim(s)]
[Claim 1]
In a laminate type battery which connected in series and laminated two or more cells,
A tab electrode for allotted voltage measurement for measuring voltage for every cell is provided in each of said cell,
A laminate type battery having arranged so that said tab electrode for allotted voltage measurement may not serve as homotopic by those which adjoin at least.
[Claim 2]
The laminate type battery according to claim 1, wherein said tab electrode for allotted voltage measurement shifts to a longitudinal direction of the cell side and is arranged at equal intervals at it.
[Claim 3]
The laminate type battery according to claim 2, wherein plural-lines arrangement of said tab electrode for allotted voltage measurement arranged by shifting at equal intervals at a longitudinal direction of said cell side is carried out.
[Claim 4]
A laminate type battery of any a pair of descriptions of Claims 1-3, wherein said tab electrode for allotted voltage measurement is arranged at both side surfaces which a cell opposes.
[Claim 5]
A laminate type battery of any one description of the Claims 1-4 connecting said cells of two or more of said laminate type batteries in parallel for connecting said tab electrodes for allotted voltage measurement.
[Claim 6]
Said laminate type battery,
A positive active material layer, a charge collector, and a negative electrode active material layer include a bipolar electrode which it comes to laminate in this order, and a polymer solid electrolyte layer,
A laminate type battery of any one description of the Claims 1-5, wherein either [at least] said positive active material layer or said negative electrode active material layer contains a solid polymer electrolyte.
[Claim 7]
The laminate type battery according to claim 6 being a rechargeable lithium-ion battery.
[Claim 8]
The laminate type battery according to claim 6 or 7, wherein negative electrode active material contained in said negative electrode active material layer is a metaled oxide or a multiple oxide of metal and lithium.
[Claim 9]
The laminate type battery according to claim 6 or 7, wherein negative electrode active material contained in said negative electrode active material layer is carbon.
[Claim 10]
The laminate type battery according to claim 9, wherein said carbon is hard carbon.
[Claim 11]
A laminate type battery of any one description of the Claims 1-10, wherein a socket which has an electrode for allotted voltage tab connection for connecting to said tab electrode for allotted voltage measurement a cell controller which controls charge voltages of said cell is connected.
[Claim 12]
The laminate type battery according to claim 10 currently uniting said cell controller with said socket.
[Claim 13]
The laminate type battery according to claim 6 when said cell controller exceeds [voltage of said cell] default value, wherein it is a current bypass circuit which electrically connects said cathode and an anode.
[Claim 14]
The laminate type battery according to claim 13, wherein said current bypass circuit contains a zener diode connected between said cathode of said cell, and an anode.
[Claim 15]
The laminate type battery according to claim 13, wherein said current bypass circuit includes a series circuit of a zener diode and a resistor which are connected between said cathode of said cell, and an anode.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention]
This invention relates to a laminate type battery.
[0002]
[Description of the Prior Art]
In recent years, reduction of carbon-dioxide emissions is eagerly desired for environmental protection. In the auto industry, expectations have gathered for reduction of the carbon-dioxide emissions by introduction of an electromobile (EV) and a hybrid electric vehicle (HEV), and development of the rechargeable battery for motor drives which holds the key to these utilization is performed wholeheartedly. Attentions have gathered for the rechargeable lithium-ion battery which can attain high energy density and high power density as a rechargeable battery.
[0003]
In order to secure high power so that it can apply to a car especially, there is a laminate type battery which connected two or more rechargeable batteries (one cell is called a cell) in series.
[0004]
In a laminate type battery, it is that each cell shares voltage so that the voltage of each cell may serve as the series-connection number of charge voltages/cell ideally.
[0005]
However, actually, since internal resistance and capacity have dispersion for every cell, variation is on the voltage which each cell shares. For this reason, degradation will advance from a cell with large allotted voltage, and the life as a laminate type battery will be restricted by the cell with this large allotted voltage.
[0006]
In order to solve such a problem, it is good for all the cells to make it it seem that the voltage shared for every cell is controlled and voltage can be shared uniformly like.
[0007]
For the purpose, it is necessary to provide the electrode for measuring that voltage to one one cell.
[0008]
For example, as invention of the capacitor with which a technical field differs from a cell to JP,2001-250741,A. In the lamination type electric double layer capacitor which laminated two or more capacitors, the composition which formed the tab for allotted voltage measurement for measuring allotted voltage to each of two or more capacitors is indicated.
[0009]
[Problem to be solved by the invention]
However, a capacitor and a cell have a big difference in electrode configuration material, a charge-and-discharge mechanism, and capacity, and technology of a capacitor cannot be simply applied to a cell.
[0010]
In the cell constituted by two or more cells, since the inter electrode distance for every cell is very short, a distance tab inter-electrode [for allotted voltage measurement] also becomes near, and has the danger of contacting mutually and short-circuiting. Since it will differ as simplistic [of a capacitor] and electric power will be continuously outputted when it should short-circuit, since electric power is continuously outputted by the chemical change in the case of the rechargeable battery, especially this has a possibility of resulting in destruction of not only a short portion but the whole cell.
[0011]
In order to avoid this, sticking an insulating film for contact prevention, for example on one side of a tab electrode for allotted voltage measurement is also considered, but only a tab electrode section for allotted voltage measurement becomes thick, and it cannot adopt [there can be a problem said that sealing nature and space efficiency fall and].
[0012]
As other problems at the time of providing a tab electrode for allotted voltage measurement, when installing a socket for amplitude measurements, or a cell controller in a tab electrode for allotted voltage measurement, a problem said that it is too near and wiring structure of a socket for amplitude measurements or a cell controller becomes complicated also has the distance between tabs.
[0013]
Then, the purpose of this invention is to provide a laminate type battery which can measure voltage for every cell.
[0014]

[Means for solving problem]
In a laminate type battery which this invention for attaining the above-mentioned purpose connected two or more cells in series, and was laminated, It is a laminate type battery having arranged so that it may not become homotopic by those which provide a tab electrode for allotted voltage measurement for measuring voltage for every cell in each of said cell, and by which said tab electrode for allotted voltage measurement adjoins it at least.
[0015]
A bipolar electrode in which it comes to laminate a positive active material layer, a charge collector, and a negative electrode active material layer in this order as for said laminate type battery in this invention, A polymer solid electrolyte layer is included and either [at least] said positive active material layer or said negative electrode active material layer contains a solid polymer electrolyte.
[0016]
In this invention, a socket which has an electrode for allotted voltage tab connection for connecting to said tab electrode for allotted voltage measurement a cell controller which controls charge voltages of said cell is connected.
[0017]
[Effect of the Invention]
According to the laminate type battery of this invention, there is no risk of the tab electrodes for allotted voltage measurement contacting and short-circuiting, and the allotted voltage of each cell can be easily measured now.
[0018]
[Mode for carrying out the invention]
Hereafter, an embodiment of the invention is described with reference to Drawings.
[0019]
Drawing 1 is a perspective view showing the general-view composition of the cell which applied this invention, and drawing 2 is a side view of the cell seen from the direction of arrow A in drawing 1.
[0020]
Two or more these cells connect with series, and laminate two or more cells. Battery structure is the bipolar battery 1 with which a positive active material layer, a charge collector, and a negative electrode active material layer include a polymer solid electrolyte layer provided between a bipolar electrode which it comes to laminate in this order, and this bipolar electrode. An internal structure as a cell of this bipolar battery 1 is mentioned later.
[0021]
And as shown in drawing 2, the tab electrodes 11-17 for allotted voltage measurement for measuring voltage for every cell are formed in a charge collector of each cell which constitutes this bipolar battery 1.
[0022]
A tab electrode for allotted voltage measurement is arranged so that those which adjoin at least may not serve as homotopic. Specifically, it is shifted and arranged at equal intervals at a longitudinal direction of the bipolar battery 1 side. The number of tab electrodes for allotted voltage measurement changes with numbers of laminations of a cell.
[0023]
The main circuit tab electrodes 19 and 20 are formed in a charge collector located in both ends of the bipolar battery 1.
[0024]
Drawing 3 is a schematic view for explaining the internal configuration of this bipolar battery 1.
[0025]
The n bipolar electrodes 30 in which, as for the bipolar battery 1, the positive electrode collector layer 32 and the negative electrode active material layer 33 were established in the charge collector 31 and this charge collector 31, The n+1 polymer solid electrolyte layer 40 was pasted together by turns, and the electrodes 21 and 22 of a cell are arranged to the polymer solid electrolyte layer 41 of the outermost layer, respectively. The electrodes 21 and 22 of a cell are connected to an external circuit by the main circuit tab electrodes 19 and 20 provided in the charge collector 31 located in the outermost layer.
[0026]
The cathode (+) terminal lateral electrode 21 is an electrode in which only the positive active material layer 32 was formed on the charge collector 31. On the other hand, the anode(-) terminal lateral electrode 22 is an electrode in which only the negative electrode active material layer 33 was formed on the charge collector 31.
[0027]
The number of times of lamination of the bipolar electrode 30 is adjusted according to the voltage for which it asks. Even if it makes thickness of a sheet-shaped cell thin as much as possible, as long as sufficient output is securable, the number of times of lamination of a bipolar electrode may be lessened.
[0028]
When using a bipolar battery, in order to prevent the shock from the outside, and environmental degradation, it is good to accommodate the cell laminated by the sheet shaped in the cell case 45. What covered inner surfaces, such as aluminum, stainless steel, nickel, and copper, with insulators, such as a polypropylene film, for example is preferred for the cell case 45.
[0029]
This bipolar battery 1 is used for the rechargeable lithium-ion battery with which charge and discharge are carried by movement of a lithium ion. however, if the effect of Hitoshi Kougami of a battery characteristic is acquired, it will not bar applying to the cell of other kinds.
[0030]
Hereafter, the composition of this bipolar battery 1 is explained further.

[0031]
[Bipolar electrode]
Drawing 4 is Drawings in which the structure of one bipolar electrode is shown.
[0032]
The bipolar electrode 30 is a structure which has arranged the positive active material layer 32 to the field of 1 of the charge collector 31 currently unified, and has arranged the negative electrode active material layer 33 to other fields. If it puts in another way, the positive active material layer 32, the charge collector 31, and the negative electrode active material layer 33 will be the structures laminated in this order.
[0033]
The cell which consists of the usual electrode to such a bipolar electrode 30 has electrically connected the positive pole collector and the negative pole collector via terminal areas (wiring etc.), when connecting a cell in series. ** -- since connection resistance arises in a terminal area, a cell [like] invites the fall of an output. Considering the miniaturization of a battery module, it becomes part disadvantage with the component which is directly unrelated to power generation like a terminal area, and the energy density of the whole part battery module is made to fall.
[0034]
a bipolar electrode -- ** -- a problem [like] is solved. That is, since the terminal area which intervenes in the electrodes connected in series does not exist, there is no fall of the output by resistance of a terminal area. Since a terminal area does not exist, the miniaturization of a battery module can be attained. The energy density of the whole part and battery module in which a terminal area does not exist improves.
[0035]
The solid polymer electrolyte is contained in either [at least] the positive active material layer 32 or the negative electrode active material layer 33 in this bipolar battery 1. By filling up the void between the active materials in an active material layer with a solid polymer electrolyte, the ion conduction in an active material layer becomes smooth, and output improvement as the whole bipolar battery can be planned.
[0036]
[A charge collector]
Drawing 5 is Drawings in which structure of one one charge collector used for a bipolar electrode of a cell in a 1st embodiment is shown.
[0037]
In the one one charge collectors 111, 112, 113, and 117, the tab electrodes 11-17 for allotted voltage measurement are formed in a position different, respectively so that a charge collector may be illustrated. And the main circuit tab electrodes 19 and 20 are formed in the direction which is different in the tab electrodes 11-17 for allotted voltage measurement in the charge collectors 111 and 117 used as the cathode (+) terminal lateral electrode 21 and the anode(-) terminal lateral electrode 22. When illustrating, about a charge collector which has the tab electrodes 14-16 for allotted voltage measurement, it was only that positions of the tab electrodes 14-16 for allotted voltage measurement differ, and since it was structurally the same, it carried out figures omitted abbreviated.
[0038]
In laminating a bipolar electrode constituted using such a charge collector, as shown in drawing 1 and drawing 2, a position of the tab electrodes 11-17 for allotted voltage measurement shifts to a longitudinal direction of the bipolar battery 1 side mutually, and ceases to lap.
[0039]
Therefore, even when the thickness of a cell is thin, 11 to tab electrode 17 comrades for allotted voltage measurement can be prevented from contacting and connecting too hastily. Since the problem which each contacts in this way with the locating position of the tab electrodes 11-17 for allotted voltage measurement itself was solved, it did not need to be said that the insulating film for contact prevention was stuck on one side of the tab electrodes 11-17 for allotted voltage measurement. For this reason, the thickness of a cell does not become thick by having formed the tab electrodes 11-17 for allotted voltage measurement.
[0040]
[Positive active material layer]
The positive active material layer 32 contains positive active material and a solid polymer electrolyte. In addition, in order to improve ion conductivity, lithium salt, an electric conduction auxiliary agent, etc. may be contained.
[0041]
As positive active material, the multiple oxide of the transition metal and lithium in which the lithium ion battery of a solution system is also used can be used. Specifically, Li-Fe system multiple oxides, such as Li-Mn system multiple oxides, such as Li-nickel system multiple oxides, such as Li-Co system multiple oxides, such as $LiCoO_2$, and $LiNiO_2$, and spinel $LiMn_2O_4$, and $LiFeO_2$, etc. are mentioned. In addition, the phosphoric acid compound and sulfated compound;V_2O_5 of transition metals, such as $LiFePO_4$, and lithium, Transition metal oxides and sulfides, such as MnO_2, TiS_2, MoS_2, and MoO_3 ;P bO_2, AgO, NiOOH, etc. are mentioned.
[0042]
The particle diameter of positive active material is good to use a thing smaller than the particle diameter for which an electrolyte is used with the lithium ion battery of the solution type which is not a solid and which is generally used, in order to reduce the electrode resistance of a bipolar battery. Specifically, it is good in the mean particle diameter of positive active material being 0.1-5 micrometers.

[0043]
A solid polymer electrolyte will not be limited in particular, if it is a polymer which has ion conductivity. As a polymer which has ion conductivity, polyethylene oxide (PEO), polypropylene oxide (PPO), these copolymers, etc. are mentioned. ** -- a polyalkylene oxide system polymer [like] may dissolve well lithium salt, such as $LiBF_4$, $LiPF_6$, $LiN(SO_2CF_3)_2$, and $LiN(SO_2C_2F_5)_2$. The outstanding mechanical strength is revealed by forming the structure of cross linkage. A solid polymer electrolyte is contained in either [at least] a positive active material layer or a negative electrode active material layer in this invention. However, in order to raise the battery characteristic of a bipolar battery more, being contained to both sides is preferred.
[0044]
As lithium salt, $LiBF_4$, $LiPF_6$, $LiN(SO_2CF_3)_2$, $LiN(SO_2C_2F_5)_2$, or these mixtures can be used. However, it is not necessarily restricted to these.
[0045]
Acetylene black, carbon black, graphite, etc. are mentioned as an electric conduction auxiliary agent. However, it is not necessarily restricted to these.
[0046]
The loadings of the positive active material in a positive active material layer, a solid polymer electrolyte, lithium salt, and an electric conduction auxiliary agent should be determined in consideration of the purposes of using a cell (output serious consideration, energy serious consideration, etc.), and ion conductivity. For example, if there are too few loadings of the solid polymer electrolyte in an active material layer, ion conduction resistance and ionic diffusion resistance within an active material layer will become large, and battery capacity will fall. On the other hand, if there are too many loadings of the solid polymer electrolyte in an active material layer, the energy density of a cell will fall. Therefore, in consideration of these factors, the amount of solid polymer electrolytes corresponding to the purpose is determined.
[0047]
The case where the bipolar battery which gives priority to cell reaction nature here using the solid polymer electrolyte (ionic conductivity: 10^{-5} - 10^{-4}S/cm) of an actual condition level is manufactured is considered concretely. ** -- in order to obtain the bipolar battery which has the feature [like], an electric conduction auxiliary agent is made more, or bulk density of an active material is lowered, and the electronic conduction resistance between active material particles is maintained lowness. A cavity part is increased simultaneously and this cavity part is filled up with a solid polymer electrolyte. ** -- it is good for processing [like] to raise the rate of a solid polymer electrolyte.
[0048]
The thickness in particular of a positive active material layer should not be limited, and as loadings were described, it should be determined in consideration of the purposes of using a cell (output serious consideration, energy serious consideration, etc.), and ion conductivity. The thickness of a general positive active material layer is about 10-500 micrometers.
[0049]
[Negative electrode active material layer]
The negative electrode active material layer 33 contains negative electrode active material and a solid polymer electrolyte. In addition, in order to improve ion conductivity, lithium salt, an electric conduction auxiliary agent, etc. may be contained. Except the kind of negative electrode active material, it may be the same as that of the contents fundamentally indicated by the clause of "positive active material."
[0050]
Although the negative electrode active material used with the lithium ion battery of a solution system can be used as negative electrode active material, especially a solid polymer electrolyte is preferred, and when the reactivity in a solid polymer electrolyte is taken into consideration, a metallic oxide or the multiple oxide of metal and lithium is preferred. Negative electrode active material is a transition metal oxide or a multiple oxide of a transition metal and lithium more preferably. Negative electrode active material is titanium oxide or a multiple oxide of titanium and lithium still more preferably.

[0051]
If it is considered as negative electrode active material, carbon is also preferred, for example. When carbon is used as negative electrode active material, a high-tension cell equivalent to the negative electrode active material containing lithium can be obtained by introducing a lithium ion into lithium. As carbon used, hard carbon is more preferred. Since the voltage change of hard carbon to change of a charging state is large compared with graphite, it becomes possible from the change of potential to predict a charging state. Therefore, the time and effort which calculates a charging state, or the equipment for it becomes unnecessary from quantity of electricity which went in and out, and the charge control of a cell and the equipment for it become easy.
[0052]
[A polymer solid electrolyte layer]
The polymer solid electrolyte layer 40 is a layer which comprises a polymer which has ion conductivity, and material will not be limited if ion conductivity is shown. As a solid polymer electrolyte, polyethylene oxide (PEO), polypropylene oxide (PPO), and a publicly known solid polymer electrolyte like these copolymers are mentioned, for example. All over the polymer solid electrolyte layer 40, in order to secure ion conductivity, lithium salt is contained. As lithium salt, $LiBF_4$, $LiPF_6$, $LiN(SO_2CF_3)_2$, $LiN(SO_2C_2F_5)_2$, or these mixtures can be used. However, it is not necessarily restricted to these. A polyalkylene oxide system polymer like PEOPPO may dissolve well lithium salt, such as $LiBF_4$, $LiPF_6$, $LiN(SO_2CF_3)_2$, and $LiN(SO_2C_2F_5)_2$. An

outstanding mechanical strength is revealed by forming the structure of cross linkage.
[0053]
Although a solid polymer electrolyte may be contained in a polymer solid electrolyte layer, a positive active material layer, and a negative electrode active material layer, the same solid polymer electrolyte may be used for it, and the solid polymer electrolyte which changes with layers may be used for it.
[0054]
The thickness in particular of a polymer solid electrolyte layer is not limited. However, in order to obtain a compact bipolar battery, it is preferred to make it thin as much as possible in the range which can secure the function as an electrolyte layer. The thickness of a general polymer solid electrolyte layer is about 5-200 micrometers.
[0055]
By the way, the polymer for solid polymer electrolytes used preferably now is a polyether system polymer like PEO and PPO. For this reason, the oxidation resistance by the side of the cathode under high temperature service is weak. Therefore, when using the cathode agent with a high oxidation-reduction potential generally used with the lithium ion battery of a solution system, few things are more preferred than the capacity of the cathode in which the capacity of an anode counters via a polymer solid electrolyte layer. Cathode potential can be prevented from going up too much at a charging end term if less than the capacity of the cathode in which the capacity of an anode counters. Here, the cathode which is a component of the same cell as "the cathode which counters via a polymer solid electrolyte layer" is pointed out. The capacity of a cathode and an anode can be calculated from manufacturing conditions as theoretical capacity at the time of manufacturing a cathode and an anode. The capacity of finished goods may be measured directly with a measuring device.
[0056]
However, since there is a possibility that anode potential may fall too much and the endurance of a cell may be spoiled when small compared with the capacity of the cathode which counters the capacity of an anode, it needs to be cautious of charge and discharge voltage. For example, it is set as a suitable value to the oxidation-reduction potential of the positive active material which uses the average charge voltages of the cell of 1, and warns against endurance falling.
[0057]
As explained above, according to the bipolar battery 1 by a 1st embodiment. Since it has the tab electrodes 11-17 for allotted voltage measurement provided so that it might shift to the longitudinal direction of the bipolar battery 1 side and might not lap with the charge collector of each cell mutually in the state where it laminated, it can do, although the allotted voltage of each cell is measured easily. And the tab electrodes 11-17 for allotted voltage measurement, Since it is provided so that it may not lap mutually in homotopic in the state where shifted to the longitudinal direction of the bipolar battery 1 side, and it laminated, fault which the tab electrodes for allotted voltage measurement which adjoin even if the thickness of a cell becomes thin contact and short-circuit is avoidable. Since it is not necessary to carry out pre-insulation of one side of the tab electrode for allotted voltage measurement by this, thickness of a cell can be made thin.
[0058]
Since these tab electrodes 11-17 for allotted voltage measurement are located in a line with the longitudinal direction of the bipolar battery 1 side at equal intervals, the structure of the socket for amplitude measurements linked to these tab electrodes 11-17 for allotted voltage measurement becomes simple, and that manufacture becomes easy.
[0059]
Since an electrolyte is a solid polymer electrolyte, the bipolar battery 1 by a 1st embodiment can prevent liquid junction between cells, even if it does not provide a special component. Since a solid polymer electrolyte is contained in an inside of an active material layer, this bipolar battery 1 is excellent in ionic conductivity inside an active material layer, and its battery characteristic of a bipolar battery is also high.
[0060]
When hard carbon is used for negative electrode active material of this bipolar battery 1, it becomes possible to perform charge control of a cell simply only by an amplitude measurement. Since a charging state of a cell is detectable by measuring voltage of a cell by using hard carbon, it can be made a high-output laminate type battery with easy composition.
(A 2nd embodiment)
Drawing 6 is a perspective view showing general-view composition of a cell of a 2nd embodiment that applied this invention, and drawing 7 is a side view of a cell seen from the direction of arrow A in drawing 6.
[0061]
A cell in a 2nd embodiment is the same bipolar battery 2 as a 1st embodiment mentioned above. And as shown in drawing 7, in a 2nd embodiment to a charge collector of the bipolar battery 2. The tab electrodes 211-217 for allotted voltage measurement arranged at equal intervals so that it may shift to a longitudinal direction of the bipolar battery 2 side and may not lap mutually in the state where it laminated, and 221-227 are provided so that it may become two rows. The number of tabs for allotted voltage measurement changes with numbers of laminations of a cell. Since it is the same as that of a 1st embodiment described with reference to drawing 3 about an internal structure of a cell, the explanation is omitted. The main circuit tab electrodes 19 and 20 are formed in a charge collector located in both ends of the bipolar battery 2 like a 1st embodiment.
[0062]
Drawing 8 is Drawings in which one one charge collector in a 2nd embodiment is shown. It can set to a 2nd embodiment as well as a 1st embodiment, and the tabs 211-217 for allotted voltage measurement, and 221-227 are fundamentally provided in a position different, respectively in the one one charge collectors 231, 232, 237, and 247 so that it may illustrate. The main circuit tab electrodes 19 and 20 are formed in the direction which is different from the tab electrode for allotted voltage measurement in the charge collectors 231 and 247 used as the cathode (+) terminal lateral electrode 21 and the anode(-)

terminal lateral electrode 22.
[0063]
And in a 2nd embodiment, the tab electrodes 217 and 221 for allotted voltage measurement are formed in the both ends of the one charge collector 217 at the charge collector 217 of the laminated cell exactly located in the middle. Thereby, a distance (for example, electrode of the couple for measuring allotted voltages, such as 216, 217, 221, 222) tab inter-electrode [for amplitude measurements] can always make it constant distance. Therefore, the structure of the socket for amplitude measurements corresponding to the tabs 211-217 [221-227, and] for allotted voltage measurement is simple, and comes to end.
[0064]
When illustrating, about the tab electrodes 214, 215, and 216 for allotted voltage measurement, and a charge collector which has 221-226, it was only that positions of a tab electrode for allotted voltage measurement differ, and since it was structurally the same, it carried out figures omitted abbreviated.
[0065]
By thus, a thing established for a tab electrode for allotted voltage measurement arranged at equal intervals at a longitudinal direction of the cell side so that it may not lap mutually in the state where it laminated according to a 2nd embodiment so that it might become two rows. Even when there are many laminations of a cell, a tab electrode for allotted voltage measurement of adjoining cells can be prevented from contacting and short-circuiting. It is having provided in both ends of the charge collector, and a tab electrode for allotted voltage measurement of a charge collector which exists in the middle of lamination among tab electrodes for allotted voltage measurement installed in two rows becomes always constant [a distance tab inter-electrode / for amplitude measurements], and its structure of a socket for amplitude measurements is simple, and it comes to end.
[0066]
(A 3rd embodiment)
Drawing 9 is a perspective view showing general-view composition of a cell of a 3rd embodiment that applied this invention, drawing 10 (a) is a side view of a cell seen from the direction of arrow A in drawing 9, and drawing 10 (b) is a side view of a cell seen from the direction of arrow B in drawing 9.
[0067]
This cell is the same bipolar battery 3 as a 1st embodiment mentioned above. And as shown in a figure, in a 3rd embodiment to the charge collector of each cell of the bipolar battery 3. The tab electrodes 311-317 for allotted voltage measurement arranged at equal intervals so that it may shift to the longitudinal direction of the bipolar battery 3 side and may not lap mutually in the state where it laminated, and 321-327 are provided in the both side surfaces which the bipolar battery 3 counters. The number of the tabs for allotted voltage measurement changes with numbers of laminations of a cell. Since it is the same as that of a 1st embodiment described with reference to drawing 3 about the internal structure of the cell, the explanation is omitted. The main circuit tab electrodes 19 and 20 are formed in the charge collector located in the both ends of the bipolar battery 3 like a 1st embodiment.
[0068]
The tab electrodes 311-317 for allotted voltage measurement provided in the both side surfaces which this bipolar battery 3 counters, and 321-327 are arranged so that it may appear in the laminating order of a cell alternately with right and left.
[0069]
Namely, the tab electrode 311 for allotted voltage measurement provided in the charge collector of the 1st cell has projected in ranking from the top in the state which showed in drawing 9 and 10 at the arrow A side of drawing 9, The tab electrode 321 for allotted voltage measurement provided in the charge collector of the 2nd cell has projected to the arrow B side of drawing 9, and the tab electrode 312 for allotted voltage measurement provided in the charge collector of the 3rd cell has projected to the arrow A side of drawing 9, and has projected alternately with right and left one by one similarly hereafter.
[0070]
Drawing 11 is Drawings in which one one charge collector in a 3rd embodiment is shown. One one charge collector in a 3rd embodiment so that it may illustrate, So that the tab electrode for allotted voltage measurement may project alternately with right and left in the laminating order of a cell, To the charge collector 331 of the 1st cell, the tab electrode 311 for allotted voltage measurement on the right-hand side of a graphic display, To the charge collector 342 of the 2nd cell, the tab electrode 321 for allotted voltage measurement on the left-hand side of a graphic display, To the charge collector 332 of the 3rd cell, the tab electrode 312 for allotted voltage measurement projects alternately with right and left similarly hereafter on the right-hand side of a graphic display, and it is formed in the last charge collector 347 so that the tab electrode 327 for allotted voltage measurement may project on the left-hand side of a graphic display. The main circuit tab electrodes 19 and 20 are formed in the direction which is different from the tab electrode for allotted voltage measurement in the charge collectors 331 and 347 used as the cathode (+) terminal lateral electrode 21 and the anode(-) terminal lateral electrode 22.
[0071]
When illustrating, about the tab electrodes 313-317 for allotted voltage measurement, and the charge collector which has 322-326, it was only that the positions of the tab electrode for allotted voltage measurement differ, and since it was structurally the same, it carried out figures omitted abbreviated.
[0072]
Thus, the tab electrodes 311-317 for allotted voltage measurement arranged at equal intervals at the longitudinal direction of the cell side so that it may not lap mutually in the state where it laminated according to a 3rd embodiment, and 321-327 by having provided in the both side surfaces of the cell even when there are many laminations of a cell, It can prevent that the tab electrodes for allotted voltage measurement of a cell contact and short-circuit. In particular, in a 3rd embodiment, since

the tab electrode for allotted voltage measurement from an adjoining charge collector will project in the cell side side which counters mutually, it can prevent more certainly that the tab electrodes for allotted voltage measurement of an adjoining charge collector short-circuit.

[0073]

(A 4th embodiment)

Drawing 12 is a perspective view showing the general-view composition of the cell of a 4th embodiment that applied this invention.

[0074]

A 4th embodiment forms the cell controller unit 400 for cell control in the bipolar battery 1 of a 1st embodiment mentioned above.

[0075]

The cell controller unit 400 has the socket and integral construction in which the electrodes 401-407 for allotted voltage tab connection corresponding to the tab electrodes 11-17 for allotted voltage measurement provided in the bipolar battery 1 were formed, as shown in drawing 13. Drawing 13 is the Drawings which looked at the socket part of the cell controller unit 400 from the electrode 401-407 side for allotted voltage tab connection.

[0076]

The cell controller unit 400 is a current bypass circuit which bypasses the electrolyte by which electrically connects a cathode and an anode to it when the voltage of a cell exceeds default value between each cathode and anode of two or more cells, and it is placed in between between them, for example.

[0077]

Drawing 14 is a circuit diagram showing an example of such a current bypass circuit.

[0078]

This current bypass circuit 50 is a circuit which connected the resistor 54 with the zener diode 52 in series between the cathode (+) and anode (-) of the cell 55. This current bypass circuit 50 makes the current at the time of charge bypass, when the zener voltage of the zener diode 52 is exceeded.

[0079]

Drawing 15 is a circuit diagram forming the current bypass circuit 50 in the cell controller unit 400 and in which showing a state.

[0080]

[in the cell controller unit 400], The current bypass circuit 50 which makes the zener diode 52 and the resistor 54 a lot will be formed, respectively between the electrodes 401 and 402 for allotted voltage tab connection, between 403 and 404, between 404 and 405, between 405 and 406, and between 406 and 407. When illustrating, between the electrodes 404 and 405 for allotted voltage tab connection, and about between 405 and 406, it carried out figures omitted abbreviated.

[0081]

And the current bypass circuit 50 will be connected in parallel to each cell of the bipolar battery 1 by this cell controller unit 400 being connected to the bipolar battery 1. And at the time of the charge to the bipolar battery 1, the zener diode 52 is connected in the direction which prevents the conduction to the current direction impressed to the cell 55. Since the charge voltages of the cell 55 which constitutes the bipolar battery 1 do not reach even zener voltage (voltage which the zener diode 52 of the current bypass circuit 50 conducts) at the beginning when charge was started, current hardly flows into the current bypass circuit 50.

[0082]

And when the voltage exceeds zener voltage, current which the zener diode 52 of the current bypass circuit 50 conducts, and flows into the cell 55 is made for voltage between terminals of the cell 55 to rise, if charge progresses, but to bypass. For example, if zener voltage uses the zener diode 52 which is 4.0V, when voltage between terminals is set to 4.0V, charge of the cell 55 will finish.

[0083]

Charge is ended automatically, and when all the current bypass circuits 50 bypass the cell 55, charge of the bipolar battery 1 ends the cell 55 with which voltage between terminals reached charge voltages. Where all the cells 55 are bypassed, current supplied to the current bypass circuit 50 connected in series from a battery charger flows, but current at this time is restricted by the resistor 54 connected with the zener diode 52 in series. Therefore, the resistor 54 is for suppressing an increase in the current, as excessive current does not flow into the current bypass circuit 50, when the current bypass circuit 50 bypasses current. A size that current through which resistance of this resistor 54 flows into the current bypass circuit 50 does not become excessive is chosen.

[0084]

In a 4th embodiment as mentioned above, By connecting the cell controller unit 400 used as a socket with which the electrodes 401-407 for allotted voltage tab connection corresponding to the tab electrodes 11-17 for allotted voltage measurement provided in the bipolar battery 1 were formed, and integral construction. Charge voltages of each cell of the bipolar battery 1 are easily controllable.

[0085]

By what it has the current bypass circuit 50 for in the cell controller unit 400. Since the current bypass circuit will operate and charge will be terminated if the charge voltages of a cell exceed default value, even if battery characteristics, such as cell capacity of a cell and internal resistance, are uneven, the uniform and optimal charge environment can be made. For this reason, since it will not be in the charging state partial for every cell but uniform charge can be performed, the life as a cell improves and reliability improves. Thus, if the current bypass circuit aiming at the prevention from overcharge of a cell is

installed, the charging state of each cell can be arranged by the full charge side, and the variation in a charging state can prevent some cells from being in an overcharging condition.
[0086]
Although the current bypass circuit 50 was made into the circuit which connected the zener diode 52 and the resistor 54 in series, only a zener diode may constitute from a 4th embodiment. However, it is more desirable to have the resistor 54 which can suppress the increase in the current to some extent so that excessive current may not flow into the current bypass circuit 50 since the charging current of a bipolar rechargeable lithium-ion battery increases when the current bypass circuit 50 bypasses current.
[0087]
(A 5th embodiment)
Drawing 16 is a perspective view showing general-view composition of a cell of a 5th embodiment that applied this invention.
[0088]
A 5th embodiment forms the cell controller unit 500 for cell control in the bipolar battery 2 of a 2nd embodiment mentioned above.
[0089]
The cell controller unit 500 in a 5th embodiment, Like a cell controller unit which unified a socket of a 4th embodiment mentioned above, as shown in drawing 17, It was made to correspond to the tab electrodes 211-217 for allotted voltage measurement of the bipolar battery 2, and 221-227, and the electrodes 501-507 for allotted voltage tab connection in a socket, and 511-517 are arranged to two rows. A current bypass circuit which consists of a CHIENA diode and resistance is established in an inside of the cell controller unit 500 like a 4th embodiment mentioned above.
[0090]
Thereby, charge voltages of each cell are easily controllable like the bipolar battery 1 by a 1st embodiment by a 2nd embodiment even if it sets bipolar battery 2.
[0091]
(A 6th embodiment)
Drawing 18 is a perspective view showing general-view composition of a cell of a 6th embodiment that applied this invention.
[0092]
A 6th embodiment connects the sockets 600 and 610 for allotted voltage tab connection for connecting to a controller for cell control the bipolar battery 3 of a 3rd embodiment mentioned above.
[0093]
As shown in drawing 19, the sockets 600 and 610 for allotted voltage tab connection were made to correspond to the tab electrodes 311-317 for allotted voltage measurement of the bipolar battery 3, and 321-327, respectively, and arrange the electrodes 601-607 for allotted voltage tab connection, and 611-617. Drawing 19 (a) is the Drawings which looked at a socket part of the socket 600 for allotted voltage tab connection from the electrode 601-607 side for allotted voltage tab connection, and drawing 19 (b) is the Drawings which looked at a socket part of the socket 610 for allotted voltage tab connection from the electrode 611-617 side for allotted voltage tab connection.
[0094]
And the tab electrodes 311-317 for allotted voltage measurement, and 321-327 are concentrated so that it may become a lot for every cell, respectively. By the tab electrodes 311 and 321 for allotted voltage measurement, namely, one cell, By the tab electrodes 321 and 312 for allotted voltage measurement, by one cell and the tab electrodes 312 and 322 for allotted voltage measurement One cell, So that the voltage of one cell can be measured in the condition --, by two tab electrodes for allotted voltage measurement which have appeared in both sides, Lines are concentrated so that the voltage of the cell corresponding to each can be measured by the electrodes 601 and 611 for allotted voltage tab connection, the electrodes 611 and 602 for allotted voltage tab connection, the electrodes 602 and 612 for allotted voltage tab connection, and --.
[0095]
It is connected to the cell controller besides a figure, and the voltage for every cell is measured, and the wiring concentrated from the tab electrode for allotted voltage measurement is controlled so that the charge of each cell becomes the same.
[0096]
(A 7th embodiment)
Drawing 20 is a perspective view showing the general-view composition of the cell of a 7th embodiment that applied this invention.
[0097]
A 7th embodiment is the cell which connected in parallel two or more battery units which provided a tab electrode for allotted voltage measurement by a tab electrode for allotted voltage measurement.
[0098]
This cell 700 is a cell which connected in parallel two or more the same bipolar battery units 701 as a bipolar battery in a 1st embodiment mentioned above for every cell by the tab electrodes 711-717 for allotted voltage measurement which each has. Therefore, as an internal structure of the cell 700, it will be in the state where the bipolar electrode 30 in the bipolar battery unit 701 was connected to parallel, respectively, as [show / in drawing 21].
[0099]
The cell controller unit 400 is attached to the tab electrodes 711-717 for allotted voltage measurement which are not connected with other bipolar battery units 701 of the bipolar battery unit 701 located in an end of this cell 700. The cell controller unit 400 is the same as what was explained in a 4th embodiment mentioned above.
[0100]

Battery structure in the one bipolar battery unit 701, The n bipolar electrodes 30 in which it is the same as that of what was explained with reference to drawing 3 in a 1st embodiment, and the positive active material layer 32 and the negative pole collector layer 33 were formed in the charge collector 31, The n+1 polymer solid electrolyte layer 40 was pasted together by turns, and an electrode of a cell is arranged to the polymer solid electrolyte layer 40 of the outermost layer, respectively.
[0101]
A charge collector used for the one bipolar battery unit 701, As shown in drawing 22, the tab electrodes 711-717 for allotted voltage measurement are formed in both sides which are positions different every charge collector 731-737 laminated as one bipolar battery unit, and counter in one charge collector. Therefore, the tab electrode side side for allotted voltage measurement in the state where laminated and it became the cell 700, It will be arranged at equal intervals so that the tab electrodes 711-717 for allotted voltage measurement may shift to a longitudinal direction of the bipolar battery unit 701 side and may not lap mutually in the state where it laminated, like a 1st embodiment mentioned above (refer to drawing 2).
[0102]
By thus, a thing for which two or more battery units which provided a tab electrode for allotted voltage measurement were connected in parallel by the tab electrodes 711-717 for allotted voltage measurement in a 7th embodiment. Either of the cells in the bipolar battery unit 701 deteriorates, and even when internal resistance becomes infinite, current comes to flow via a cell in another bipolar battery unit 701 connected to the cell and parallel by tab electrode for allotted voltage measurement. for this reason -- a case where a cell in one of the bipolar battery units 701 deteriorates -- the cell 700 -- use can be continued, without causing degradation rapid as a whole.
[0103]
(An 8th embodiment)
An 8th embodiment is the vehicles carrying a laminate type battery by this invention. Specifically, the 1st mentioned above - a bipolar battery by a 7th embodiment, and a bipolar battery which attached the 4th - a cell controller unit by a 7th embodiment more preferably are carried in an under floor part of vehicles as the cell group 800, as shown in drawing 23.
[0104]
More than one connect in series and/or in parallel by the main circuit tab electrodes 19 and 20 of a bipolar battery, and this cell group 800 is that of ****.
[0105]
Such a cell group 800 is used as a power supply for a drive of the vehicles 801, such as a cell electromobile or a hybrid electric vehicle. The setting position of the cell group 800 can be installed not only in the under floor part in vehicles but in the inside of Amai in an engine room.
[0106]
Thereby, it is safe and it also becomes can provide a hybrid vehicle with sufficient fuel consumption performance, and an electromobile, and moreover there is also little degradation for every cell in a cell, and possible the life as a cell, and to lengthen the changing-battery cycle of vehicles, since it can lengthen.
[0107]
Although the embodiment which applied this invention above was described, This invention is not what is limited to these embodiments. For example, to say nothing of [it is also possible to carry out combining the element of each embodiment suitably, and] the ability to carry out as various forms in the range of technical idea of this invention in a person skilled in the art, they belong to the range of this invention.
[Brief Description of the Drawings]
[Drawing 1]It is a perspective view showing the general-view composition of the cell in a 1st embodiment that applied this invention.
[Drawing 2]It is a side view of the cell seen from the direction of arrow A in drawing 1.
[Drawing 3]It is a schematic view for explaining the internal configuration of a bipolar battery.
[Drawing 4]They are Drawings in which the structure of a bipolar electrode is shown.
[Drawing 5]They are Drawings in which the structure of one one charge collector in a 1st embodiment is shown.
[Drawing 6]It is a perspective view showing the general-view composition of the cell in a 2nd embodiment that applied this invention.
[Drawing 7]It is a side view of the cell seen from the direction of arrow A in drawing 6.
[Drawing 8]They are Drawings in which one one charge collector in a 2nd embodiment is shown.
[Drawing 9]It is a perspective view showing the general-view composition of the cell of a 3rd embodiment that applied this invention.
[Drawing 10]Drawing 10 (a) is a side view of the cell seen from the direction of arrow A in drawing 9, and drawing 10 (b) is a side view of the cell seen from the direction of arrow B in drawing 9.
[Drawing 11]They are Drawings in which one one charge collector in a 3rd embodiment is shown.
[Drawing 12]It is a perspective view showing the general-view composition of the cell of a 4th embodiment that applied this invention.
[Drawing 13]They are the Drawings which looked at the socket part of the cell controller unit used for a 4th embodiment from the electrode side for allotted voltage tab connection.
[Drawing 14]It is a circuit diagram showing an example of a current bypass circuit.
[Drawing 15]It is a circuit diagram forming the current bypass circuit 50 in a cell controller unit and in which showing a state.
[Drawing 16]It is a perspective view showing the general-view composition of the cell of a 5th embodiment that applied this invention.
[Drawing 17]They are the Drawings which looked at the socket part of the cell controller unit used for a 5th embodiment from

the electrode side for allotted voltage tab connection.
[Drawing 18]It is a perspective view showing the general-view composition of the cell of a 6th embodiment that applied this invention.
[Drawing 19]They are the Drawings which looked at the socket for allotted voltage tab connection used for a 5th embodiment from the electrode side for allotted voltage tab connection.
[Drawing 20]It is a perspective view showing the general-view composition of the cell of a 7th embodiment that applied this invention.
[Drawing 21]They are Drawings in which the state where the bipolar electrode in a bipolar battery unit was connected to parallel, respectively is shown.
[Drawing 22]They are Drawings in which one one charge collector in a 7th embodiment is shown.
[Drawing 23]They are Drawings in which the vehicles in a 7th embodiment that applied this invention are shown.
[Explanations of letters or numerals]
1, 2, 3 -- Bipolar battery
11-17, 211-217, 311-317, 321-327 -- Tab electrode for allotted voltage measurement
19, 20 -- Main circuit tab electrode
21 -- Cathode (+) terminal lateral electrode
22 -- Anode(-) terminal lateral electrode
30 -- Bipolar electrode
31 -- Charge collector
32 -- Positive active material layer
33 -- Negative electrode active material layer
40, 41 -- Polymer solid electrolyte layer
41 -- Polymer solid electrolyte layer
45 -- Cell case
50 -- Current bypass circuit
52 -- Zener diode
54 -- Resistor
55 -- Cell
111, 112, 113, 117, 217, 231, 231, 232, 237, 247, 331, 332, 342, 347, 731, 732, 733, 737 -- Charge collector
400, 500 -- Cell controller unit
401-407, 501-507, 511-517, 601-607, 611-617 -- Electrode for allotted voltage tab connection
600, 610 -- Socket for allotted voltage tab connection
700 -- Cell
701 -- Bipolar battery unit
731 -- Charge collector
800 -- Cell group
801 -- Vehicles

[Translation done.]